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MALARIA IN FLORIDA[1,2]

D. B. LIEUX

CDC Entomologist, Division of Entomology, Florida State Board of Health
Jacksonville, Florida

During recent years, the principal approach to malaria control and prevention in Florida has been the DDT residual spray program. Initiated in 1945, this activity was a cooperative one, with the Florida State Board of Health, local health departments, and the U. S. Public Health Service participating. The program involved spraying of walls, ceilings, porches, and privies of unscreened or poorly screened houses with DDT in those areas whose epidemiological history showed a high incidence of malaria. The effectiveness of these treatments has been determined principally by their ability to maintain houses free of the malaria vector. The tendency of malaria mosquitoes to rest and linger within houses, especially after a blood meal, has been well established and it is this characteristic which results in control by means of the interior residual spraying of homes. Evaluation of control operations was based on inspections made in both sprayed and unsprayed houses. These data, during the period control operations were conducted, showed that an average of 97 percent of the sprayed houses inspected were found to be free of *Anopheles quadrimaculatus* as compared to 68 percent of the unsprayed houses inspected. Through 1950, 313,081 houses in forty counties of Florida have been treated. In addition to enhancing malaria control and prevention, these treatments have simultaneously yielded a high degree of control of other house-frequenting insects. While the concurrent control of houseflies since 1948 has been relatively poor, apparently due to resistance to DDT, there is no evidence to indicate that anophelines have developed any significant degree of resistance to this insecticide, under field conditions.

Reported cases and deaths from malaria in Florida during the period 1917 through 1949 are shown in Figure 1. The peak year of reported cases appears to have occurred during 1919, when 1,895 cases were reported. During 1929, a record 470 deaths from the disease were reported. The graphs indicate a

[1] From the Communicable Disease Center, Public Health Service, Federal Security Agency, Atlanta, Georgia.

[2] Presented at the Annual Meeting, Florida Entomological Society, December, 1950.

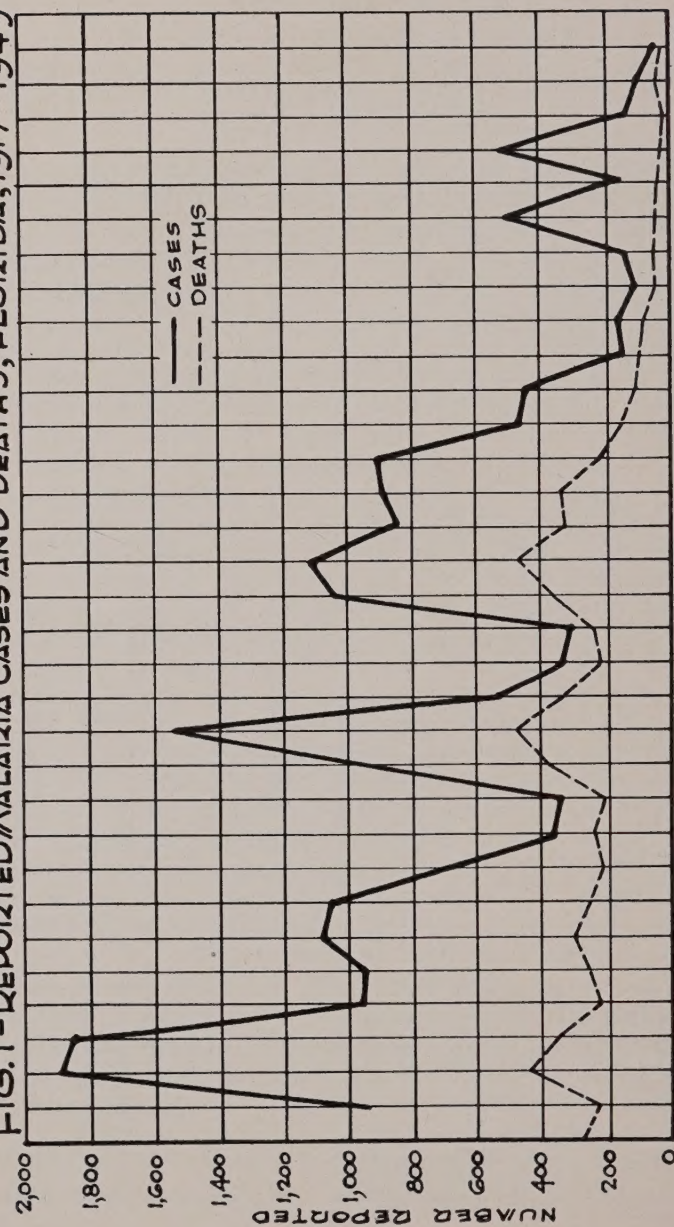


FIG. 1 - REPORTED MALARIA CASES AND DEATHS, FLORIDA, 1917-1949
CASES
DEATHS
NUMBER REPORTED
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1917
1920
1925
1930
1935
1940
1945
1949
YEARS

cyclic decline, during the period observed, the exact cause or causes for which have never been clearly demonstrated. Judicious speculation may attribute this decline in malaria to a combination of factors difficult to accurately evaluate. Undoubtedly the economic status of the population has played an important role, greatly influencing the individual's ability to purchase household insecticides, to provide screening and other protective measures, medical care, and physical resistance commensurate with the standard of living. During and following the depression years, extensive drainage projects were conducted by Federal relief agencies which resulted in a quantitative reduction of the malaria vector. Improved education and regulatory measures, pertaining to water impoundments, likewise appear to have enhanced this decline. Substantial increases in reported malaria cases during 1944 and 1946 may be attributed to "imported" malaria, principally involving armed forces personnel. The DDT residual spray program may logically be presumed to have materially assisted in preventing a resurgence of malaria during and subsequent to this period.

Due to the present low incidence of malaria in Florida, the Public Health Service has withdrawn financial support of county-wide DDT residual spray programs. To supplant this, a malaria surveillance and prevention program is contemplated for the Fiscal Year beginning July 1, 1951. In each of the thirteen Southeastern States where malaria has not been eradicated, the Communicable Disease Center of the Public Health Service proposes to organize, in cooperation with the States, federally supported malaria surveillance and prevention teams whose primary responsibilities shall be the prevention and elimination of malaria. Ideally, a team shall consist of an epidemiologist, an entomologist, and an engineer.

RESPONSIBILITIES OF THE EPIDEMIOLOGIST: The epidemiologist should investigate and appraise each case of malaria in the State as soon as feasible. Cases should receive the following priority in investigation:

a. Laboratory confirmed cases.
b. Cases reported from areas known to have been previously malarious and cases reported by doctors known to have given bona fide reports in the past.
c. Rumors and unofficial reports of malaria.
d. Other malaria reports.

The determination of priority investigation in any of the above categories should be the responsibility of the state epidemiologist. If appraisal indicates the possibility of recent local transmission of malaria, immediate steps should be taken to determine the source and the extent of spread of the infection, specifically by house to house epidemiological investigation and thick film surveys. After epidemiological appraisal has located a positive or presumptive case, the epidemiologist should make available his findings and interpretations to the other members of the team for appropriate control procedures.

A continuing and primary responsibility of the epidemiologist assigned to malaria surveillance should be to assist the state epidemiologist in promoting better morbidity reporting of malaria.

A secondary responsibility of the epidemiologist, after all responsibilities on malaria appraisal and surveillance are fulfilled, should be to participate in finding, investigating, and appraising typhus fever cases. He should encourage physicians to obtain confirmation of their diagnoses by means of rickettsial complement fixation.

A tertiary responsibility of the epidemiologist should be to obtain epidemiologic information concerning other communicable diseases.

RESPONSIBILITIES OF THE ENTOMOLOGIST: In the vicinity of positive or presumptive malaria cases, the entomologist should determine prevalence, abundance, and local distribution of malaria vectors. After control operations are undertaken, the entomologist should determine their effectiveness.

The secondary responsibility of the entomologist is to participate with the engineer and state epidemiologist in the planning and operation of typhus control and evaluation activities.

The tertiary responsibility of the entomologist is to search for vector species where insect-borne diseases are reported, and to participate in the promotion and conduct of programs for controlling insects of public health inmportance.

RESPONSIBILITIES OF THE ENGINEER: The engineer's primary responsibility will be to determine and conduct appropriate insect control operations around positive or presumptive malaria cases. This will include responsibility for the assignment and management of CDC equipment and materials.

The secondary responsibility of the engineer shall be the organization, operation and direction of typhus control pro-

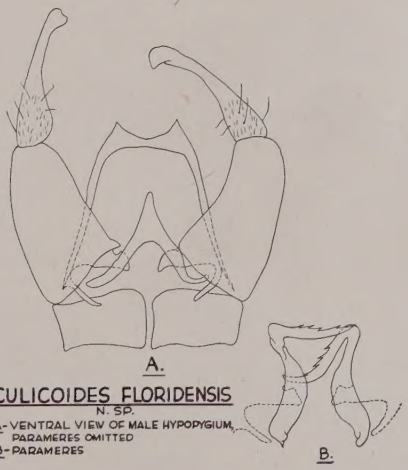
grams within the state. The tertiary responsibility shall be the promotion and technical supervision of locally sponsored insect control activities.

The above outlined program should result in more accurate reporting of malaria, assist in economically directing the final phases of malaria eradication, and more clearly define the existing status of malaria in this nation.

A NEW *CULICOIDES* FROM FLORIDA (DIPTERA, CERATOPOGONIDAE)

ELIZABETH C. BECK [1]

During the course of a study of the distribution of *Culicoides* in Florida, conducted from November, 1948, through September, 1950, a new species of *Culicoides* was found in light trap material and is herewith described.



Culicoides floridensis n. sp.

FEMALE: Uniformly light golden yellow with unspotted wings, mesonotum and legs unmarked. Approximately 1.1-1.2 mm. long as compared to 1.6-1.7 mm. length in *C. melleus*. There are two spermathecae, clear, with a broad ring and rudimentary spermatheca. In *C. melleus* the spermathecae are black and there is a conspicuous rudimentary spermatheca, but no apparent ring.

[1] Division of Entomology, Florida State Board of Health.

MALE: Coloration as in female; antennal flagellum golden brownish. Hypopygium (see fig.); apicolateral processes of the ninth tergite very small; dorsal process of side piece long and slender, inner process boathook shaped; aedoeagus shaped like an inverted V, similar to that of *C. stellifer;* parameres are similar to those of *C. haematopotus,* but stouter with knob-like projections on the base and finger-like projections near top of stem, the tips longer and slenderer. In Root and Hoffman's (1937) key by male hypopygium this species keys out to *C. stellifer.*

The following specimens are deposited in the United States National Museum: Male holotype (U.S.N.M. No. 60924), Englewood, Sarasota County, Florida; Female allotype, Englewood, Sarasota County, Florida. Male and female paratypes are deposited in the Museum of Zoology, University of Michigan.

This species most closely resembles *C. melleus,* except in size. It has thus far been taken only in Sarasota County, at Englewood on the Gulf coast, and at Myakka State Park which lies about fifteen miles inland. It seems probable that this species is not a salt water breeder.

The author wishes to acknowledge the aid and advice of Dr. W. W. Wirth of the United States Museum, and Mr. R. H. Foote of U. S. Public Health Service.

LITERATURE CITED

Root, T. M. and W. A. Hoffman. 1937. The North American Species of *Culicoides.* Amer. Jour. of Hyg. 25 (1): 150-176.

BOOK NOTICE

HORNED BEETLES, A STUDY OF THE FANTASTIC IN NATURE, by Gilbert J. Arrow, edited by W. D. Hincks. iv + 154 pages, 15 plates. 1951. Dr. W. Junk, Publishers, The Hague.

For the entomologist interested in a study of some of the most bizarre insect forms in the world, the book by the late Dr. Arrow, who was associated with the British Museum (Natural History) for many years, gives an excellent coverage of the subject. The book is interestingly written, well printed, and has a good series of photographs showing the remarkable development of horns on the Coleoptera. Unfortunately, some of the plates have been crowded and consequently the photographs suffer. There are author, general, and scientific indexes. The book should prove useful and informative to the amateur as well as the professional entomologist.—L. B.

CONCERNING SOME AMERICAN MICROVELIA (HEMIPTERA: VELIIDAE)

C. J. DRAKE [1] and R. F. HUSSEY [2]

This paper is based entirely upon specimens of the genus *Microvelia* Westwood in the private collections of the authors. It includes the descriptions of two new species, new synonymical and distributional records, and discriminative notes on polymorphic forms of several little-known species. The types of both new species are in the Drake collection, paratypes of *M. pexa* in the collections of both authors. In the descriptions given here, 1 millimeter equals 80 micrometer units.

Polymorphism and especially sexual dimorphism of the apterous forms are very pronounced in many species of veliids. The occurrence of marked sexual dimorphism in apterous individuals appears to be independent of polymorphism. Thus it is necessary to characterize several types of individuals in a single species. The striking differences in forms of the same species, as well as widely separated and interrupted distributional records, account for part of the synonymy.

Original descriptions of a number of the species are wholly inadequate for their identification. In addition, both the sexes as well as both alate and wingless forms are not always represented in long series. Even in the largest collections many species are not represented by both sexes of apterous and macropterous forms. As a result several species of *Microvelia* described by the earliest workers in the genus are still imperfectly known.

Numerous species of Microvelia, such as *M. summersi* Drake and Harris, *M. munda* Drake and *M. hinei* Drake, rank among the tiniest "pygmies" of the waterstriders, measuring less than two millimeters in length. And, curiously enough, these little dwarfs are often very widely, though sometimes spottily distributed. When fully fledged they are capable of sustained flight. One of the most diminutive pygmies is *M. hinei,* which is represented in our collections by specimens from Canada, many states of the United States, Mexico, Insular and Central America, and south into Brasil and Peru. In Florida this species sometimes comes through window screens to lights. Another widely distributed form is *M. albonotata* Champion, described

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[2] Florida Southern College, Lakeland, Florida.

from Guatemala but ranging from New York southward through the eastern United States to the West Indies, Mexico and Central America. It has been found in numbers in Panama (Drake) and is plentiful in woodland habitats in Florida (Hussey).

Many species of *Microvelia* are shy and timid, dwelling on the quiet waters close to shore (often among partly submerged vegetation) in the secluded recesses and quiet coves of pools, ponds and lakes. And, too, similar types of favorable habitats in slow-moving waters of large and small streams are not infrequently inhabited by several species, notably *M. americana* and some of the forms related to it.

Microvelia summersi Drake and Harris

Microvelia summersi Drake and Harris, 1928, Fla. Ent. 12: 8.

This very short robust species is represented by the types from *GRENADA,* B. W. I., and a series of alate individuals from *PANAMA,* Canal Zone, taken Feb. 10, 1939, by C. J. Drake. Antennal formula, I:II:III:IV = 10:7:8:13. The wingless form is unknown. *M. summersi* is the shortest of the group of small robust species with short stout appendages. The other members of this group are *M. venustatis* Drake and Harris, *M. lujanana* Drake, and *M. marginata* Uhler.

Microvelia venustatis Drake and Harris

Microvelia venustatis Drake and Harris, 1933, Proc. Biol. Soc. Wash. 46: 53.

This species, described from "Brazil", is now known to range widely over tropical South America. The notes which follow are based on specimens from: *BRASIL,* Rio de Janeiro, Nov. 6, 1938 (C. J. Drake); *PARAGUAY,* Colonia Independencia, near Villarrica, Nov. 13, 1931 (R. F. Hussey); and east-central *PERU,* Tingo María, Sept. 9, 1944 (E. J. Hambleton). At Colonia Independencia both alate and apterous individuals were found in large numbers on a quiet pool in a grass-bordered brook. The apterous form has not been characterized before, nor have the male genital characters been described.

APTEROUS FORM: Male, length 1.31 mm., humeral width 0.65 mm. Female, length 1.38 mm., humeral width 0.80 mm., width at 4th abdominal segment 0.82 mm. Very dark plumbeous, almost black, the dorsum with fine prostrate pilosity which is more evident on the first two connexival segments and toward the sides of the first two abdominal tergites; pronotum

with a transverse flavo-testaceous band anteriorly, this band somewhat emarginate behind at the middle; sides of the thorax and entire venter with sparse prostrate silvery pubescence; first antennal segment, second rostral segment, trochanters, femora (except the tips), and tibiae beneath, flavous; last three antennal segments, base and apex of the rostrum, tips of the femora, tibiae above, and tarsi, fusco-testaceous; last two connexival segments above and below commonly (though not always in the males) with the outer half flavous, the extreme edge very narrowly brown.

Pronotum not divided into two lobes by a transverse suture, the posterior half with fine punctures in two irregular transverse rows (not visible in some males); hind margin of pronotum varying from nearly straight to distinctly emarginate at the middle; disk with a most obsolete longitudinal median ridge anteriorly; antero-lateral portion with (♀) or without (♂) some erect hairs. Mesonotum visible only as a narrow transverse strip behind the pronotum, entirely concealed beneath it at the sides, its hind margin widely transversely excavated, its median length 5/16 (♀) to 4/18 (♂) that of the pronotum; a deep arcuate phragmal impression each side just behind the "humeral angle" of the pronotum. Metanotal triangles extended forward along the postero-lateral margin of the pronotum about to the middle of the latter, their median angles truncated, depressed, apparently fused with the mesonotum. First abdominal tergite of males as long as (18:18) the second and third tergites together, of females slightly longer (20:18); first tergite with a deep fovea each side on the basal half, punctiform in males, distinctly transverse in females. Sixth and seventh tergites commonly with a narrow glabrous median line, narrower on the sixth segment and abbreviated at both ends; seventh tergite of female as long as (15:15) the fifth and sixth tergites together, seventh tergite of male slightly longer (15:13). Fourth antennal segment longest, about equal in length to the anterior interocular distance, distinctly shorter (16:20) than the posterior interocular width as seen from above.

MALE: Genital segments withdrawn into the venter, the first one appearing as a narrow flavous ring, broadly interrupted beneath by a U-shaped excavation which is largely concealed by the last ventral segment, the exposed part of the margins of this excavation diverging anteriorly and bearing a row of 8 to 10 long flavous hairs, this segment also thickly set externally with yellow hairs, directed upward, on its dorso-lateral portion. Second genital segment not protruding beyond the first, broadly subconical as seen from behind, not visible from above.

Microvelia marginata Uhler

Microvelia marginata Uhler, 1893, Proc. Zool. Soc. London, p. 719.

Microvelia pudoris Drake and Harris, 1936, Proc. Biol. Soc. Wash. 49: 105. (NEW SYNONYMY.)

Specimens of *M. marginata* Uhler from *GRENADA*, B. W. I. (determined by Dr. W. E. China of the British Museum) are identical with the type series of *M. pudoris* D. & H. from the

same island; the latter name is here synonymized with *M. marginata,* whose types were from *ST. VINCENT.*

In addition to the material from Grenada, numerous specimens of *M. marginata* have been examined from: *PERU,* Tingo María, Sept. 9, 1944 (E. J. Hambleton); *PANAMA,* Canal Zone, Feb. 6-8, 1939 (C. J. Drake); Barro Colorado, C. Z., Feb. 10, 1939 (C. J. Drake); *VENEZUELA,* Barinitas, Dec. 1942 (P. Anduzee); and *TRINIDAD,* B. W. I., Oct. 27-29, 1938 (C. J. Drake). The apterous form is not represented in our collections.

Winged males and females of *M. marginata* agree closely in size with *M. venustatis* D. & H., but are readily separable by the pale and distinctly pitted hind margin of the pronotum; and the under side of the first genital segment of the male is without the oblique rows of long hairs found in *M. venustatis. M. summersi* D. & H. is a shorter species. The antennal formula of *M. marginata* is: I:II:III:IV = 10:9:11:18.

Microvelia fasciculifera McKinstry

Microvelia fasciculifera McKinstry, 1937, J. Kans. Ent. Soc. 10(1): 31.

Specimens of this very distinct species are at hand from: *ARIZONA,* Huachuca Mts., Aug. 1934 (C. J. Drake); Santa Rita Mts., Aug. 9, 1934 (E. D. Ball). *MEXICO,* Durango (H. F. Wickham); Real de Arriba, Temescaltepec, May 13, 1923 (Hilton and Usinger); Colonia Garcia, Chihuahua, May 13, 1923 (D. E. Beck); Mexico City, D. F., July 30, 1950 (C. J. Drake).

WINGED FORM: Length 3.75 mm., width 1.60 mm., gradually narrowed from the humeral angles backward. Blackish, with short brownish pubescence; pronotum with a rectangular spot on each side (or a band interrupted at the middle) near the anterior margin, also the posterior margin of the hind process (except at the middle), testaceous or brownish-testaceous. Hemelytra dark fuscous, the veins a little darker and clothed with short brownish pubescence, the outer vein also with some brownish hairs at the base. Pronotum moderately convex, wider across the humeral angles (124:100) than long on the middle line; median raised line present but not prominent. Pronotum in front and sides of head with short silvery hairs; width of head across the eyes 0.88 mm.; head with the usual impressed median line. Antennae long, dark fuscous, shortly darkly pilose, formula I:II:III:IV = 42:40:45:42. Legs slender, fuscous with the bases paler, clothed with brownish hairs on dark areas and with much longer pale hairs beneath on testaceous areas. Abdomen bluish black beneath.

MALE: Last ventral segment with a prominent cone-shaped tuft of stiff dark hairs on the middle line slightly behind the middle. First genital

segment very long, its upper side slightly narrowed posteriorly, with the hind margin deeply excavated; under side basally with the margins sharply raised to form a deep cup-like cavity with truncate base, the rim on each side just before the apex distinctly raised and there beset with long, erect, dark bristly hairs; immediately behind the cup-like cavity the concave hind margin is deeply broadly excavated apically as in other members of the *M. americana* group.

The dense cone-like tuft of long hairs on the last ventral segment and the singularly formed under side of the male first genital segment are very distinctive characters for the recognition of this species.

Microvelia pexa, new species

APTEROUS FORM: Moderately large, subfusiform (male) or broadly ovate (female); blackish, with several small patches of silvery pubescence or silvery hairs; pronotum with the transverse rufous-brown band interrupted at the middle. Connexiva of the male concolorous with the tergites, those of female with a large quadrate brownish spot in each segment. Legs dark fuscous with the bases pale; femora and tibiae testaceous beneath; front femora largely brownish above. Abdomen bluish black beneath.

SIZE: Male, length 3.00 mm., width 1.15 mm., female, length 2.75 mm., width 1.30 mm. Antennal formula, male, I:II:III:IV = 36:35:40:41; female, 32:30:34:35.

THORAX: Pronotum short, not produced posteriorly, slightly longer than the posterior lobe of mesonotum, but distinctly (⅓ to ½) shorter than the anterior mesonotal lobe, which is narrowed posteriorly and broadly truncate behind; metanotal triangles narrow, transverse, their median angles acute.

ABDOMEN: Length, male, 2.20 mm.; female, 1.62 mm. Abdomen gradually narrowed behind in males, broadly ovate in females and with wider connexiva.

MALE: Thorax and abdomen above rather densely clothed with fine erect dark hairs which may be difficult to see unless viewed from the side; abdomen with slightly coarser and slightly longer hairs. Legs rather densely clothed with moderately long pale hairs which are paler on testaceous surfaces; hairs longer on middle and hind femora, many of them nearly or quite twice as long as the diameter of the femur; tibial hairs usually about twice as long as the diameter of the tibia at their point of origin, sometimes not longer than its diameter. Hind femora armed beneath on distal half with numerous short black teeth or short blunt spines. Genital segments large, blackish, with long hairs; first segment, seen from above, slightly narrowed posteriorly, broadly and deeply emarginate on the hind margin. Under side of first genital segment very broad, deeply and roundly impressed basally with the apex rather sharply rounded and reflexed, there beset with a thick, transverse crescent-shaped comb of long pale bristly hairs just in front of the roundly produced margin; basal discal impression black at the bottom, the raised brown lateral sides and

base beset with a thin ring of long, laterally projecting pale hairs pointed toward the center of the saucer-like depression; deeply broadly excavated beyond the discal impression as in other species of the *americana* group. Second genital segment small, unarmed.

Type (male), *allotype* (female) and 20 *paratypes, MEXICO,* Mexico City, D. F., July 30, 1950 (C. J. Drake and F. C. Hottes). Other *paratypes, MEXICO:* 8 specimens, Valles, July 30, 1950; 3 specimens, Puebla, July 29, 1950; 2 specimens, Aguascalientes, Aug. 5, 1950; 2 specimens, Guadalajara, Aug. 4, 1950; Durango, Aug. 6, 1950; Cuernavaca, July 30, 1950 (all collected by C. J. Drake).

Most closely related to *M. irrasa* Drake and Harris,, but smaller, with shorter hairy clothing and different antennal formula. *M. gerhardi* Hussey has the under side of the first genital segment (male) somewhat similar in construction, but lacks the clothing of long hairs on legs and body. The females of both *M. pexa* and *M. irrasa* are very broad, and distinctly broadly ovate. The winged form of *M. pexa* is unknown.

Microvelia costaiana, new species

APTEROUS FORM: Moderately large, elongate, testaceous, the sutures between tergites and connexival segments brownish black; sides of pronotum and head in front blackish. Legs dark fuscous-brown, the tibiae and femora beneath, almost all of fore femora above, bases of middle and hind femora above, coxae, trochanters, meso- and metasternum, and prosternum pale testaceous. Abdomen beneath blackish with bluish lustre; connexiva beneath and last two segments of venter testaceous. Length 2.00 mm., width 0.55 mm.

HEAD: Width across the eyes 0.55 mm. Head with two broad yellowish brown stripes between the eyes, coalescing posteriorly; median line indistinct behind. Antennae brown-fuscous, the base paler; segment I moderately stout, almost entirely pale beneath, slightly curved; II much more slender, a little thicker apically; III and IV very slender, practically equal in thickness. Antennal formula, I:II:III:IV = 16:11:24:34. Rostrum testaceous, the terminal segment blackish.

THORAX: Pronotum twice as wide (40:20) as long, covering posteriorly about half the mesonotum, feebly convex behind; mesonotum nearly one-half as long as the pronotum, clothed with short hairs which are pale in testaceous areas, brownish in darkened areas; hind femora unarmed, scarcely thicker than the other pairs, subequal to the tibiae in length. Tarsal segments of both middle and hind legs subequal in length.

ABDOMEN: Length 1.25 mm., width 0.58 mm. Last tergite nearly twice as long as the preceding tergite. Venter without tubercles, slightly flattened; last segment much longer than the preceding, truncate behind. Male genital segments dark fuscous, moderately hairy; first genital segment moderately wide as seen from above, truncate behind, slightly nar-

rowed apically with the sides distinctly convex; beneath with a short smooth base, thence deeply and broadly excavated; second segment beneath testaceous, very strongly flattened, with some short hairs but without tufts.

Type (male), *BRASIL*, Rio de Janeiro, Nov. 6, 1938 (C. J. Drake).

The completely flattened under side of the second ventral segment at once distinguishes this species from its allies. The venter, genital segments and hind femora are without tubercules or spines. The female and the alate forms are unknown. *M. sarpta* Drake and Harris, from Brasil, has quite differently formed genital segments, and its middle femora are greatly enlarged and strongly compressed and are much stouter than the other femora. In *M. costaiana* the middle femora are not at all stouter than the others. This species is named in honor of the noted Brasilian entomologist Dr. A. M. da Costa Lima.

Microvelia braziliensis McKinstry

Microvelia braziliensis McKinstry, 1937, J. Kansas Ent. Soc. 10(1): 36.

The winged form of this species is characterized here from a female taken on a spring-fed pool at Colonia Troche, *PARAGUAY*, Nov. 17, 1931 (R. F. Hussey). Colonia Troche is about 35 km. northeast of Villarrica on the road to Caaguazú. Apterous individuals were found Nov. 18, swarming on temporary rain-water pools in the road through the forest between Colonia Troche and Caaguazú. Apterous specimens collected by E. J. Hambleton are before us from *PERU* (Aguaytia, Sept. 7, 1944) and *ECUADOR* (El Topo, Oct. 5, 1944), and thus *M. braziliensis* has a very wide range in tropical South America.

ALATE FEMALE: Length 3.55 mm., humeral width 1.31 mm., width of head across the eyes 0.78 mm. Dark fuscous; head dull flavo-testaceous, a narrow median line and a fovea each side near the hind angle of the eye, black. Pronotum slightly wider than long (105:95), narrowly black-margined in front, behind this with a percurrent, uninterrupted, dull testaceous transverse band; disk rather tumidly convex, lightly depressed within the somewhat elevated humeral angles and along the posterior margins, coarsely, shallowly and remotely punctate and covered with fine, prostrate, rather scanty silvery pubescence; median carina faintly suggested on the highest part of the disk, not visible elsewhere; a transverse row of punctures at the hind margin of the transverse fascia; the elevated and thickened humeral angles very faintly emarginate, they and the narrow margins of the posterior process obscure honey-yellow. Hemelytra obscurely testaceous along the basal part of the costal margin, elsewhere dark fuscous,

the three apical cells and the median pre-apical cell faintly paler, the last-named with a vague median ocellate dark spot; costa (especially toward the base) and the corial veins set with silvery hairs somewhat longer than those on the pronotum, and also with a few longer black hairs. All femora with rather sparse long pale hairs beneath on the basal two-thirds of their length, many or most of these hairs twice as long as the thickness of the femur. Fourth antennal segment subequal in length (60:62) to the width of the head including the eyes, the third segment very little shorter (58 units).

Microvelia mimula B. White

Microvelia mimula Buchanan White, 1879, J. Linn. Soc. Lond., Zool. 14: 487.

Microvelia myersi McKinstry, 1937, J. Kans. Ent. Soc. 10(1): 32. (NEW SYNONYMY.)

Microvelia mimula China, 1943, Proc. Roy. Ent. Soc. Lond. Ser. B, 12: 121.

This quite striking species can be separated from its congeners by the small tubercle on the penultimate ventral segment of the male. In addition, the second genital segment has on each side, near the hind margin, a long, straight, sharp, horizontal spine projecting laterally; each of these spines is about as long as the width of the segment itself. The first genital segment is very broad and is widened apically to permit the spine-bearing segment to be exserted or retracted, and its broad posterior margin is very deeply emarginate. Since the antennal formula is the same in both sexes, the females too are readily separable from closely allied species.

M. mimula is quite similar to *M. albonotata* Champion in form and size, and both have the conspicuously silvery white spots on the hemelytra. Their antennal formulas are different. *M. mimula* has a small tubercle on the penultimate ventral segment of the male, while *M. albonotata* has an extremely large testaceous tubercle at the base of the male venter. The spines of the male second genital segment of *M. albonotata* are directed downward for about half their length and then are turned obliquely outward, and are noticeably flattened on their outer sides.

APTEROUS FORM: Male, length 1.60 mm., width 0.51 mm.; female, length 1.95 mm., width 0.56 mm. Color testaceous with some brown or blackish markings on the pronotum; legs and antennae as in the winged form.

HEAD: Width across the eyes 0.45 mm. Broad; brownish, the median line more or less obsolete posteriorly. Antennal formula, I:II:III:IV = 19:11:21:36.

THORAX: Pronotum covering a large part of the mesonotum, longer than wide (male, 46:22; female, 52:21); mesonotum with lateral angles visible; mesonotum slightly more exposed in female than in male, from ⅓ to ⅖ as long as the pronotum. Hind femora of male with a long row of sharp spines, beneath, plus a few adventitious spines or a partial second row.

ABDOMEN: Broader in female than in male; connexival margins almost straight in male, but wider in female with outer margin distinctly convex. Male venter with a small tubercle on the penultimate segment, as in winged form.

The authors are greatly indebted to Dr. R. J. Izzard for his kindness in sending four determined specimens of *M. mimula* (China, loc. cit.) collected by Dr. Noel Hynes in *TRINIDAD*, B. W. I. Many other specimens are at hand from: *BRASIL*, Rio de Janeiro, Nov. 18, 1938 (C. J. Drake); Teutonia, Sta. Catharina, June 10, 1950 (Fritz Plaumann); *ECUADOR*, Guayaquil (F. Campos); *PARAGUAY*, Colonia Troche, Villarrica Distr., Nov. 17, 1931 (R. F. Hussey); Estancia Primera, Caaguazú Distr., Dec. 8, 1931 (R. F. Hussey); *ARGENTINA*, Buenos Aires, Dec. 18, 1938; Luján, Dec. 18, 1938; Tigre, Nov. 20, 1938; Sancti Spiritu, Jan. 9, 1939 (all C. J. Drake).

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THE AQUATIC AND SEMIAQUATIC HEMIPTERA OF NORTHERN FLORIDA. PART 4: CLASSIFICATION OF HABITATS AND KEYS TO THE SPECIES

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CLASSIFICATION OF HABITATS

Sand-Bottomed Streams

Many of the small streams in northern Florida may be classified in the sand-bottomed category. The water is swift and usually quite dark due to seepage and drainage from flatwoods and swamps. There is practically no vegetation associated with the stream proper.

Twenty-four species of aquatic and semi-aquatic Hemiptera have been taken in this type of stream. The most typical are the gerrids and the rhagovelias. *Gerris nebularis* as well as one species of *Rhagovelia* are found only in swift-flowing sand-bottomed streams and those of a calcareous nature. *Microvelia alachuana* is confined to the sand-bottomed streams. Most of the aquatics have been taken only in areas where an accumulation of hyacinths have formed or in the small pools where the water is rather still and leaf debris has collected. Species present in sand-bottomed streams are:

**Gerris nebularis*
G. canaliculatus
**Metrobates anomalus comatipes*
Limnogonus hesione
**Rheumatobates rileyi*
**R. tenuipes*
**Rhagovelia choreutes*
Microvelia borealis
**M. alachuana*
**Velia brachialis*
Hydrometra myrae
H. australis
Mesovelia mulsanti
Pelocoris femoratus
Ranatra australis
**R. nigra*
**R. buenoi*
Belostoma lutarium
B. testaceum
Lethocerus uhleri
Trichocorixa louisianae
T. verticalis verticalis
T. naias
Sigara zimmermani

Calcareous Springs and Streams

Calcareous springs and streams, which form one of the most interesting ecological habitats, occur in many areas in the highlands region and along the Gulf Coast. They are characterized by clear, cold water derived from huge springs of calcareous nature.

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* Characteristic forms are indicated by an asterisk.

The most striking fact about the water-bug fauna of this type of habitat is the superabundance of the supraneuston fauna and the almost complete absence of aquatic forms. All of the calcareous streams visited have been extremely rich in water striders. No other habitat offers either the abundance or variety of forms encountered. Huge colonies of the swifter forms dart over the surface or may be found resting in compact masses in the shade of overhanging branches and under bridges. On only one occasion has an aquatic species been taken. A few specimens of one of the hot-bugs (*Pelocoris* sp.) were collected in the roots of water hyacinths present in the stream.

Two species, *Hydrometra wileyi* and *Trepobates pictus*, have been collected only in calcareous streams. The former is represented in my collection by numerous specimens collected at Salt Creek and Peace River. *T. pictus* is known to me only from a few specimens taken in Rainbow River in company with *Metrobates hesperius ocalensis*.

The water bugs that have been collected in calcareous streams are:

Gerris nebularis
G. canaliculatus
**Trepobates pictus*
Limnogonus hesione
**Rheumatobates rileyi*
**R. tenuipes*
**Metrobates hesperius depilatus*
**M. h. ocalensis*
**M. anomalus comatipes*
Microvelia borealis
**Rhagovelia choreutes*
Velia brachialis
V. watsoni
Mesovelia mulsanti
Hydrometra myrae
H. australis
**H. wileyi*
Pelocoris sp.

Swamp-and-Bog Streams

The swamp-and-bog stream, with a pH ranging from 4.3 to 5.2, is not a common type in northern Florida. To my knowledge, only one, Blue's Creek, occurs in the Gainesville region. Its location is not well known due to its relative isolation. This stream originates along the west side of a shallow cypress swamp and meanders through a hydric hammock. Its banks are rather indefinite for some distance. The water is sluggish, strongly stained, and flows over deposits of semi-suspended silt.

The faunal list for this habitat is small but interesting. Ten species of Hemiptera occur here, four of which are characteristic. *Microvelia buenoi* and *Notonecta uhleri* are confined to swamp-and-bog streams and *Velia watsoni* and *Hydrometra australis* are found in them more frequently than elsewhere, al-

though both are capable of withstanding the more alkaline waters of calcareous streams. Species present are:

Gerris canaliculatus
**Microvelia buenoi*
M. hinei
**Velia watsoni*
Hydrometra myrae
**Hydrometra australis*
Ranatra buenoi
**Notonecta uhleri*
Trichocorixa naias
Sigara zimmermani

Larger Rivers

North-Central Florida is bounded by two rivers, the St. Johns on the east and the Suwannee on the west. Both of these have been investigated and the waterbug fauna in them has been found to be very meager.

I have collected at only one locality on the Suwannee. This was at the crossing of U. S. Highway 19. At this point the water is very dark and the shore zones are completely devoid of vegetation. Extensive areas of yellow sand are clean-swept by the rapid current. Chable (1947) points out the variation in vegetation zones in this river from its source to the mouth. No waterbugs were collected here on any of the several trips to this river.

The St. Johns, although differing in its arrangement of ecological microhabitats, differs very little from the Suwannee in its aquatic hemipteran fauna. I believe that the few species that have been collected here are present owing to the abundance of water hyacinths which probably brought them into the river from the bordering swamps and small creeks. Most of the collecting was done about four and one-half miles southeast of Bostwick. During the years 1941 to 1948, a hyacinth trap was in operation approximately thirty yards south of my collecting point. No waterbugs, except a few corixids, were observed during this time. In early 1948, the trap began to collapse and large rafts of hyacinths now float along the shores. At that time, several belostomatid nymphs, a single *Ranatra australis* and numerous *Mesovelia mulsanti* were collected along the edge of the river in the masses of hyacinths.

Lakes

Rogers (1933) and Chable (1947) suggest a distinction between the hammock-region and sand-shore lakes. They may be recognized as distinct types on the basis of their geological origin. Those of the sand regions were formed by the solution of lime-

stone at considerable depth beneath the surface of the water, and occupy many of the deeper depressions of the rolling pine and scrub country. They are probably the deepest of the Florida lakes and have a large expanse of open water. The lakes of the hammock-region are usually more shallow and their surfaces are not much lower than that of the surrounding terrain. According to Sellards (1914), the hammock-region lakes were formed along the course of a former stream. From the standpoint of aquatic Hemiptera there is very little basis for a consistent division of these two types of lakes. Most of the lakes appear to be composite in origin and they may show all degrees of succession in some part of their basins so that there is little consistency from one lake to another. Thus, the lakes usually are inhabited by all of the aquatic forms of the surrounding region. However, there is some tendency for the belostomatids to be more abundant in the hammock-region lakes. This abundance may be due to the shallowness of the water in these lakes and the predominance of marsh vegetation. *Microvelia albonotata* is known only from a sand-shore lake, and *Ranatra kirkaldyi* is also known from this type of lake, and one other locality.

List of species present in hammock-region lakes:

Limnogonus hesione
Velia brachialis
Mesovelia mulsanti
Hydrometra myrae
Pelocoris femoratus
Ranatra nigra
Belostoma lutarium
Notonecta indica
Plea striola
Palmacorixa buenoi
Trichocorixa naias
T. minima

List of species present in sand-shore lakes:

Gerris canaliculatus
Velia brachialis
Microvelia albonotata
Hydrometra myrae
Ranatra kirkaldyi
Palmacorixa buenoi
Sigara zimmermani
S. bradleyi
Pelocoris sp.
P. femoratus
Trichocorixa naias
T. minima

Sinkhole Ponds

Sinkholes, many holding water, are a conspicuous element in the Central Highlands since the area was developed upon a karst topography of relatively slight elevation. Stubbs (1940) has discussed the effect of solution on the geomorphology of peninsular Florida.

More species of waterbugs have been taken from sinkholes than from any other type of habitat. Of the thirty-one listed

below, twenty-two are true aquatics. Fourteen of the forms are characteristic of the habitat, although none of them are confined to it. Many creeks enter sinkholes and may bring their respective faunas with them into the sink. Species present are:

Gerris nebularis
G. canaliculatus
**Limnogonus hesione*
Microvelia hinei
**M. borealis*
**Velia brachialis*
**Mesovelia mulsanti*
M. amoena
**Hydrometra myrae*
**Pelocoris femoratus*
**P. carolinensis*
Pelocoris sp.
Ranatra drakei
**R. australis*
**R. buenoi*
**R. nigra*
Lethocerus uhleri
**Belostoma lutarium*
B. testaceum
**Notonecta indica*
Buenoa scimitra
B. elegans
B. margaritacea
**Plea striola*
**Hesperocorixa martini*
Palmacorixa buenoi
Sigara sigmoidea
S. zimmermani
S. bradleyi
Trichocorixa naias
T. minima

Nymphaea Marshes

Nymphaea marshes, representing a stage of succession of ponds and lakes, are common in northern Florida.

Like the other habitats that are rich in vegetation, the Nymphaea marsh has an extensive waterbug fauna. Twenty-four species have been collected, of which eleven are more or less characteristic. The fauna is predominantly aquatic; only eight of the forms are water striders. Species present are:

Gerris canaliculatus
**Limnogonus hesione*
Microvelia hinei
M. borealis
Velia brachialis
**Mesovelia mulsanti*
M. amoena
**Hydrometra myrae*
**Pelocoris* sp.
**P. femoratus*
**Ranatra nigra*
R. australis
Ranatra buenoi
R. kirkaldyi
**Benacus griseus*
**Belostona lutarium*
**B. testaceum*
**Lethocerus uhleri*
Abedus immaculatus
Plea striola
Hesperocorixa brimleyi
Trichocorixa minima
T. naias
**T. louisianae*

Fluctuating Ponds

In Northern Florida, numerous shallow ponds are found that have been formed by the local solution of thinly-buried, shallow,

limestone strata. Their basins have very indefinite margins and during the rainy seasons they may fluctuate several feet. The permanent water is seldom more than eighteen inches deep, and usually less. Some of these ponds disappear during the dry seasons and are therefore not capable of supporting true hydrophytics. In more permanent fluctuating ponds, the water is filled with submerged, floating and emergent vegetation.

Two rather definite types of fluctuating ponds have been investigated, the hammock-region and the flatwoods fluctuating ponds. The first of these types is found in dense hammocks where it is well shaded. When the shade is very heavy, the bottom of the pond is usually covered with a thick layer of leaf debris, and the submerged and shore vegetation are not well developed. Receding water leaves a broad zone of bare, black muck along the shore, often covered by layers of leaf debris. From the standpoint of waterbugs, the hammock-region fluctuating pond is distinct from the flatwoods type. The notonectids and corixids are more common in the former than in any other type of pond. The list of twenty-seven species found in the first type is almost twice as large as that of the second. Species found in hammock-region fluctuating ponds are:

Gerris canaliculatus
G. nebularis
Microvelia hinei
M. borealis
Velia brachialis
Mesovelia mulsanti
M. amoena
Hydrometra myrae
H. australis
Pelocoris femoratus
Pelocoris sp.
Ranatra buenoi
R. nigra
R. drakei
Belostoma lutarium
B. testaceum
**Notonecta indica*
**Buenoa margaritacea*
**B. elegans*
B. scimitra
**Hesperocorixa martini*
H. nitida
**Sigara sigmoidea*
**S. bradleyi*
S. zimmermani
Trichocorixa minima
T. naias

The flatwoods fluctuating ponds are situated on poorly drained, flat terrain. Their basins are very shallow and most of them dry up completely at least once a year. Sixteen species, of which belostomatids are the most characteristic, have been collected in this type of pond. Species present in flatwoods fluctuating ponds are:

Gerris canaliculatus
Limnogonus hesione
Mesovelia mulsanti
**Hydrometra myrae*

Pelocoris femoratus
**P. carolinensis*
**Ranatra australis*
**Benacus griseus*
**Lethocerus uhleri*
**Abedus immaculatus*
Notonecta indica
**Buenoa limnocastoris*
**B. margaritacea*
B. scimitra
Sigara bradleyi
**S. sigmoidea*

Cypress Swamps

Cypress swamps are a conspicuous feature of northern Florida. The cool, dark water is well shaded and numerous rotting logs are partly submerged in the black mud of the bottom. Waterbugs are not abundant in cypress swamps. Thirteen species have been collected, of which only three are characteristic. Species present are:

**Gerris canaliculatus*
Limnogonus hesione
Rheumatobates tenuipes
**Mesovelia mulsanti*
Hydrometra myrae
**H. australis*
Pelocoris femoratus
Ranatra nigra
Belostoma lutarium
Notonecta indica
Plea striola
Hesperocorixa brimleyi
Trichocorixa naias

Miscellaneous Habitats

ROADSIDE DITCHES: The fauna of the roadside ditches is not distinct from that of other smaller bodies of water. The sometimes temporary habitats usually reflect the character of the surrounding terrain. In flatwoods, the roadside ditches are almost identical with the fluctuating flatwoods ponds in respect to their fauna. However, many of the smaller water striders, as well as *Gerris canaliculatus*, seems to reach their peak of abundance in these situations. Species present are:

Gerris canaliculatus
Limnogonus hesione
Microvelia borealis
M. hinei
Velia brachialis
Mesovelia mulsanti
Abedus immaculatus
Notonecta indica
Plea striola
Trichocorixa naias

BORROW PITS: Borrow pits are artificial ponds formed by the removal of soil, usually for use on public roads. They lend a peculiar appearance to the landscape since they are often square or rectangular in shape. Only four species of Hemiptera have been taken from these pits:

Mesovelia mulsanti
Buenoa margaritacea
Sigara sigmoidea
Trichocorixa naias

MUDHOLES: This classification is included since some species of Corixidae may be confined to this type of habitat. A single mudhole yielded three species of corixids, two of which are known from no other locality. For a discussion of this habitat, see part 3 of this series (under discussion of *Hesperocorixa interrupta*). Species present are:

Hesperocorixa nitida **Sigara hubbelli*
**H. interrupta*

SEWAGE DUMPS: The sewage dumps may prove to be a fertile habitat in which to collect notonectids. Over four hundred specimens of *Notonecta indica* and *Buenoa scimitra* were collected in a few minutes at the Alachua Airbase sewage dump.

KEY TO THE FAMILIES OF AQUATIC AND SEMIAQUATIC HEMIPTERA [1]

1. Antennae shorter than head 2
1′. Antennae as long or longer than head, exposed; semiaquatic 8
2. Ocelli present; semiaquatic 3
2′. Ocelli absent; aquatic 4
3. Antennae exposed; front and middle legs similar ..... OCHTERIDAE
3′. Antennae concealed; front legs raptorial, eyes protuberant ..... GELASTOCORIDAE
4. Hind tarsi with indistinct setiform claws (except Pleidae which are less than 3 mm. long) 5
4′. Hind tarsi with distinct claws 6
5. Head overlapping thorax dorsally. Front tarsi 1-segmented, palaeform ..... CORIXIDAE
5′. Head inserted in thorax. Front tarsi normal ..... PLEIDAE and NOTONECTIDAE
6. Membrane of hemelytra reticulately veined 7
6′. Membrane of hemelytra without veins ..... NAUCORIDAE
7. Apical appendages of abdomen long and slender; tarsi 1-segmented ..... NEPIDAE
7′. Apical appendages of abdomen short and flat, retractile; tarsi 2-segmented ..... BELOSTOMATIDAE
8. Head as long as entire thorax; both elongated. Length about ten mm. ..... HYDROMETRIDAE [2]
8′. Head shorter than thorax, including scutellum 9
9. Claws of at least the front tarsi distinctly anteapical, with terminal tarsal segment more or less cleft 10
9′. Claws all apical, last segment entire 11

[1] The families Ochteridae, Gelastocoridae, Hebridae, Saldidae and Naucoridae are included in this key.
[2] See Herring (1948) for a key to the species of this family.

10. Hind femur extending much beyond apex of abdomen; intermediate and hind pairs of legs approximated, very distant from front pair. Beak 4-segmented ..... GERRIDAE
10′. Hind femur not extending much beyond apex of abdomen; intermediate pair of legs about equidistant from front and hind pairs (except in *Rhagovelia*, in which case the third tarsal is split and bears a tuft of feathery hairs); beak 3-segmented ..... VELIIDAE
11. Antennae usually 5-segmented; first and second segments thicker than the others; clavus similar in texture to the membrane, which is without veins; head and thorax sulcate beneath ..... HEBRIDAE
11′. Antennae 4-segmented; other characters not as above 12
12. Membrane of wing without cells, or apterous ..... MESOVELIIDAE
12′. Membrane of wing with 4 or 5 long closed cells, never apterous ..... SALDIDAE

KEY TO THE GENERA OF GERRIDAE

1. Inner margin of the eyes concave or sinuate behind the middle; body comparatively long and narrow, abdomen long 2
1′. Inner margin of the eyes convexly rounded; body short and broad, abdomen usually very short 3
2. Pronotum sericeous, dull; basal joint of front tarsi but little shorter than apical one ..... GERRIS
2′. Pronotum glabrous, shining; basal joint of front tarsi much shorter than apical one ..... LIMNOGONUS
3. First antennal segment nearly equal to the remaining three united; much longer than second and third segments united; hind femora twice as long as hind tibia ..... METROBATES
3′. First antennal segment much shorter than the other three united; only slightly longer than second and third segments united, sometimes shorter 4
4. Fourth antennal segment equal to or shorter than third; hind femora equal to or shorter than hind tibia and tarsus united; abdomen as long as remainder of body, strongly tapering toward apex ..... RHEUMATOBATES
4′. Fourth antennal segment distinctly longer than third; abdomen much shorter than remainder of body ..... TREPOBATES

KEY TO THE SPECIES OF GERRIS

1. First antennal segment distinctly longer than second and third united; larger, length 14-16 mm.; sixth ventral of male with a deep, broad median furrow ..... G. NEBULARIS Drake and Hottes
1′. First antennal segment usually shorter than second and third united; smaller, length 8-11 mm.; hind margin of sixth ventral of male broadly rounded and without a median furrow ..... G. CANALICULATUS Say

LIMNOGONUS

Only one species occurs in this area.....L. HESIONE (Kirkaldy)

KEY TO THE SPECIES OF METROBATES [3]

1. First antennal segment shorter, averaging about ⅕ longer than the width of the head including the eyes, slightly shorter than the other three together; dorsal coloration largely black, the mesonotum and mesopleuron as seen from above not marked with gray, except through reflection ..... M. ANOMALUS Hussey
1′. First antennal segment longer, averaging about ⅓ longer than the width of the head, slightly longer than the other three segments together; mesonotum and mesopleuron as seen from above marked with gray ..... M. HESPERIUS Uhler

KEY TO THE SPECIES OF RHEUMATOBATES

1. Hind legs of male normal, prothorax of female three times as wide as long; several rather long hairs on the sides of the prothorax ..... R. TENUIPES Meinert
1′. Hind legs of male incrassated, curved or deformed, prothorax of female four times as wide as long; no long hairs on prothorax ..... R. RILEYI Bergroth

TREPOBATES

Only one species occurs in this area ..... T. PICTUS (Herrich-Schaeffer)

KEY TO THE GENERA OF VELIIDAE

1. Fourth antennal segment longest; front tarsi 2-jointed..... MICROVELIA
1′. First antennal segment longest; front tarsi 1 or 3-jointed 2
2. Middle tarsi with the third joint split, the cleft with a tuft of feathery hairs; front tarsi 1-jointed; color black or leaden gray ..... RHAGOVELIA
2′. Middle tarsi not split and without feathery hairs; front tarsi 3-jointed; color brown or brownish yellow ..... VELIA

KEY TO THE SPECIES OF MICROVELIA

1. Antennae longer than head and thorax taken together; posterior tibiae straight in both sexes 3
1′. Antennae equal to or shorter than head and thorax together 2
2. Antennae shorter than head and thorax taken together; posterior tibiae curved in male; male elongate, female orbiculate .... M. BOREALIS Bueno
2′. Antennae equal to head and thorax taken together; posterior tibae straight in both sexes; sexes similar in form ..... M. HINEI Drake
3. First and third antennal segments subequal in length 4
3′. First antennal segment shorter than third, fourth subequal to second and third taken together. Hemelytra marked with white; apterous form glabrous, slender; color brown and yellow ..... M. ALBONOTATA Champion
4. Fourth antennal segment much shorter than second and third taken

[3] See Hussey and Herring (1949) for a key to the subspecies of *M. anomalus* and *M. hesperius*.

together; males with the sides of the abdomen almost straight, subconical; females with numerous long hairs on the apex of the last abdominal segment, one-half as long as the length of the segment on which they arise ..... M. ALACHUANA Hsy & Hrg.

4'. Fourth antennal joint slightly longer than second and third taken together; other characters not as above ..... M. BUENOI Drake

RHAGOVELIA

Only one species occurs in this area ..... R. CHOREUTES Hussey

KEY TO THE SPECIES OF VELIA

1. Middle and hind tarsi subequal in length, the former with joints two and three subequal; head not immersed in thorax to eyes; antennae with joints two, three and four subequal in length; hind margin of pronotum with a fringe of long hairs; form slender .... V. WATSONI Drake

1'. Middle tarsi distinctly longer than hind ones, the former with joint two much longer than three; head immersed in thorax to eyes, form robust ..... V. BRACHIALIS Stal

FAMILY MESOVELIIDAE

(One genus, *Mesovelia*)

KEY TO THE SPECIES OF MESOVELIA

1. Hind margin of front and middle femora with a row of spines; first genital segment of male with tufts of black setae on lower side, length of body 3.8 to 4 mm. ..... M. MULSANTI White

1'. Hind margin of front and middle femora without a row of spines; first genital of male without tufts of black setae on lower side, length of body not over 2.8 mm. ..... M. AMOENA Uhler

FAMILY NEPIDAE

(One genus, *Ranatra*)

KEY TO THE SPECIES OF RANATRA

1. Antennae simple, distal end of penultimate segment without a lateral prolongation; front femora broad, stout and not constricted near middle; usually without apical tooth or sinuation ..... R. KIRKALDYI Bueno

1'. Antennae with distal end of penultimate segment with a lateral prolongation; front femora distinctly narrowed in front of submedian tooth 2

2. The lateral prolongation of the distal end of penultimate segment not more than one-half the length of the ultimate segment; front femora very slender and without apical tooth 3

2'. The lateral prolongation of the distal end of penultimate segment more than one-half the length of the ultimate segment; median tooth of anterior femora nearer distal than proximal end 4

3. Prosternum with a single wide, deep longitudinal trough; eyes rather prominent ..... R. BUENOI Hungerford

3′. Prosternum without the deep trough, but possessing two longitudinal depressed lines ..... R. NIGRA Herrich-Schaeffer

4. Front femora with an apical tooth; legs not or very faintly annulated; front portion of pronotum, along the median dorsal line, more than twice as long as thickened basal portion; eyes large, diameter greater than width of interocular space ..... R. DRAKEI Hungerford

4′. Front femora broad without an apical tooth; front femora and tibia annulated ..... R. AUSTRALIS Hungerford

KEY TO THE GENERA OF BELOSTOMATIDAE

1. Anterior femora not sulcate ..... BENACUS

1′. Anterior femora sulcate for the reception of the tibia 2

2. Metasternum with a longitudinal keel, membrane of hemelytra reduced ..... ABEDUS

2′. Metasternum without a longitudinal keel, membrane of hemelytra not reduced 3

3. Head conically produced, rostrum long, thin; length less than 30 mm. ..... BELOSTOMA

3′. Head not conically produced, rostrum short, stout; length 40 or more mm. ..... LETHOCERUS

BENACUS

Only one species occurs in northern Florida ..... BENACUS GRISEUS (Say)

ABEDUS

Only one species occurs in northern Florida ..... A. IMMACULATUS (Say)

KEY TO THE SPECIES OF BELOSTOMA

1. Length 20 or more mm.; head as long as middle of pronotum; tylus convex, very prominent; body strongly tapering behind middle of elytra ..... B. LUTARIUM (Stal)

1′. Length 14-18 mm.; head not as long as middle of pronotum; tylus not prominent ..... B. TESTACEUM (Leidy)

LETHOCERUS

Only species occurs in northern Florida ..... L. UHLERI (Montandon)

KEY TO THE GENERA OF NOTONECTIDAE

1. Claval commissure without a pit at anterior end; scutellum almost as long as claval commissure ..... NOTONECTA

1′. Claval commissure with a pit at anterior end. Scutellum little if any more than half the length of claval commissure ..... BUENOA

KEY TO THE SPECIES OF NOTONECTA

1. Anterior breadth of vertex about 2½ times the width of the synthlipsis;

typical color light with a broad black band across distal end of the hemelytra ..... N. INDICA Linné

1'. Anterior breadth of vertex about 6 times the width of the synthlipsis; hemelytra brick-red to orange with a black blotch on corium ..... R. UHLERI Kirkaldy

KEY TO THE SPECIES OF BUENOA

1. Claval orifice less than one-third the length of scutellum, scutellum as long as or longer than pronotum, one-half or more the length of claval commissure 2

1'. Claval orifice one-third or more the length of scutellum, scutellum shorter than pronotum, not over one-third as long as claval commissure 3

2. Anterior tarsal segment two about two-thirds the length of segment one; Pronotum of males with four distinct depressions, thus appearing tricarinate; stridular area on front femora of males small, oval, with not more than 15 cross ridges; length not over 8 mm. ..... B. MARGARITACEA Bueno

2'. Anterior tarsal segment two about one-half the length of segment one; pronotum in both sexes with very feeble or no depressions; stridular area on front femora of male sword-shaped, with 30 or more cross ridges ..... B. SCIMITRA Bare

3. Interocular area very narrow, the eyes of male subcontiguous at base; anterior tarsal segment two about two-thirds of segment one; smaller, less than 6 mm.; stridular area of male with 5 or 6 ridges ..... B. ELEGANS (Fieber)

3'. Interocular area wider in both sexes, one-third to one-half as wide at base of eyes as in front; pronotum of male distinctly arched and inflated; larger, 6.2-7.5 mm.; stridular area of male with 4-5 widely separated stridular grooves ..... B. LIMNOCASTORIS Hungerford

FAMILY PLEIDAE

Represented by one genus and one species ..... PLEA STRIOLA Fieber

KEY TO THE GENERA OF CORIXIDAE

1. Small shining insects less than 5.6 mm. long; males with sinistral asymmetry and with palae short, triangular, the tibia produced apically over it; females with the apices of the clavi not exceeding a line drawn through the costal margins of the hemelytra at the nodal furrows ..... TRICHOCORIXA

1'. Combination of characters not as above 2

2. Rugulose species with rear margin of head sharply curved, embracing a very short pronotum; interocular space much narrower than the width of an eye; dorsal median lobe of the seventh abdominal segment of the male bearing a hook-like projection; males with dextral asymmetry ..... PALMACORIXA

2'. Combination of characters not as above 3

3. Small, less than 5.6 mm. long; males with dextral asymmetry; lateral

lobes of the prothorax elongate, linguiform; anterior tibia with a few small apical spines ..... SIGARA

3'. Larger, not less than 8 mm. long; males with dextral asymmetry; lateral lobes of the prothorax quadrate; front tibia of males with a subapical spiniform bundle of stiff hairs ..... HESPEROCORIXA

KEY TO THE SPECIES OF TRICHOCORIXA

1. Males 2
1'. Females 3

2. Strigil oval, not elongate 4
2'. Strigil elongate, either curved or linear 5

3. With a very noticeable tuft of hair at apex of each clavus ..... T. LOUISIANAE Jaczewski
3'. Without a tuft of hair at the apex of each clavus at most two or three setae 6

4. With not more than five yellow lines separating the black transverse bands on pronotum; row of pegs on pala almost straight and parallel to the inner margin of the palm ..... T. MINIMA (Abbott)
4'. With six or more yellow lines separating the black transverse bands on the pronotum; row of pegs on pala decidedly curved near apex and oblique ..... T. NAIAS Kirkaldy

5. Strigil definitely curved from left to right, somewhat sickle-shaped; left posterior lobe of abdomen with the lateral lobe convex, often expanded from anterior lateral angle to apex ..... T. LOUISIANAE Jaczewski
5'. Strigil straight from left to right, transverse; left posterior lobe of abdomen with the lateral anterior angle produced to form a lobe, causing the lateral margin to appear concave at some region along distance to apex ..... T. V. VERTICALIS (Fieber)

6. Apices of the clavi not reaching a line produced through the costal margins of the hemelytra at the nodal furrow 7
6'. Apices of the clavi slightly exceeding a line produced through the costal margins of the hemelytra at the nodal furrows; with six or more yellow lines separating the black transverse bands on the pronotum; these sometimes broken; costal margin of hemelytra deeply emarginate just anterior to nodal furrow ..... T. NAIAS Kirkaldy

7. Nodal furrow appearing absent or at apex of embolar groove; with not more than five yellow lines separating the black transverse bands on pronotum; costal margin of hemelytra slightly emarginate anterior to nodal furrow ..... T. MINIMA (Abbott)
7'. Nodal furrow dividing the pruinose area of embolar groove into apical and basal portions; with numerous yellow lines separating the black transverse bands on pronotum; costal margin not emarginate ..... T. V. VERTICALIS (Fieber)

PALMACORIXA

Only one species occurs in northern Florida ..... P. BUENOI Abbott

KEY TO THE SPECIES OF SIGARA

1. Pronotal disk laterally reduced; metaxyphus about as broad as long; 4 to 6 pegs on dorsal surface of hind femur; length 4.6-5.6 mm. ..... S. HUBBELLI (Hungerford)
1′. Pronotal disk not laterally reduced; metaxyphus broader than long; length less than 5 mm. 2
2. Less than 4 mm. long; right margin of 7th abdominal segment of male without a lateral projection; pala of female not depressed ..... S. BRADLEYI (Abbott)
2′. More than 4 mm. long; right margin of 7th abdominal segment of male with a lateral projection; pala of female depressed near apex 3
3. Hind femur pubescent ventrally for only slightly more than half its length and with a row of short spines on dorsal surface; length 4.1-4.5 mm. ..... S. SIGMOIDEA (Abbott)
3′. Hind femur pubescent ventrally for two-thirds its length and with only two or three spines or none on dorsal surface; length 4.5-5 mm. ..... S. ZIMMERMANI (Fieber)

KEY TO THE SPECIES OF HESPEROCORIXA

1. Mesoepimeron at level of scent gland osteole considerably broader than the lateral lobe of the prothorax; legs suffused with bright red ..... H. BRIMLEYI Kirkaldy
1′. Mesoepimeron at level of scent gland osteole plainly narrower than the lateral lobe of the prothorax 2
2. Color pattern normal 3
2′. Color pattern in part effaced, at least on corium .... H. LUCIDA (Abbott)
3. Hind femur with a row of about 10 spines ventrally on distal portion of rear margin ..... H. NITIDA (Fieber)
3′ Hind femur with a row of about 6 spines ventrally on distal portion of rear margin 4
4. Short, rather stout species, more than one-third as wide as long; hemelytra heavily rastrate, middle femora stout and spinose ..... H. MARTINI (Hungerford)
4′. Species about one-third as wide as long; not so heavily rastrate; middle femora not stout and spinose; metaxyphus arrow-shaped, no longer than broad; strigil of male very long ..... H. INTERRUPTA (Say)

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MINUTES OF THE THIRTY-FOURTH ANNUAL MEETING OF THE FLORIDA ENTOMOLOGICAL SOCIETY

The thirty-fourth annual meeting of the Florida Entomological Society was held in Winter Haven, in the Citrus Building during September 13th and 14th, 1951. The meeting started at 10:00 a.m., September 13th, with papers being given during the morning and afternoon sessions. The program was divided into four main groups as follows: Miscellaneous Insects, Vegetable Insects, Insects Affecting Man and Animals, and Citrus Insects. Thirty-one papers were presented before the society. A most enjoyable hospitality hour was provided by Industry in the Florida Room of the Citrus Building, followed by a banquet. President W. G. Bruce was toastmaster at the banquet. One hundred and twenty-three members and guests signed the attendance register.

The business meeting was called to order by President Bruce at 11:00 a.m., September 14th. The reading of the minutes of the 1950 meeting was dispensed with as they had been published in Volume 34, No. 1 of the FLORIDA ENTOMOLOGIST. President Bruce called for old business, and the first item was a report from the Constitutional Committee by Dr. J. W. Wilson. The Committee recommended a change in the election of new members of the society. The following constitutional amendment was presented by Dr. Wilson and seconded by Dr. W. V. King, passed with a vote of 36 to 0.

ARTICLE III—Membership

Section 1. All persons having entomological training or a sincere interest in entomology may become active members of the Society. Application for membership will be endorsed by two members of the Society, accompanied by the payment of the annual dues and submitted by the Membership Committee to the Executive Committee for action. The Secretary will notify the applicant of the action taken.

Section 2. Honorary membership may be conferred by action of the Society on anyone who has performed long and distinguished service in the field of entomology. Any active member may propose the name of a person for Honorary Membership. This name should be submitted in writing to the Membership Committee not less than thirty (30) days prior to an annual meeting.

Section 3. Upon payment of one hundred dollars ($100.00) any active member may become a life member and shall thenceforth be granted the privileges of the Society, be exempt from annual dues, and supplied with THE FLORIDA ENTOMOLOGIST without further charge.

Mr. Jack Russell read a report prepared by Mr. Toffaletti, who was Chairman of the Membership Committee of the society which was charged during the 1950 meeting to study the "ways and means of the Society." Mr. Toffaletti's report follows:

1. Members arrear in payment of dues: that a mimeographed letter be sent again to such members urging them to forward amount due and, if not received in a reasonable time, that such members be dropped from the rolls of the Society in accordance with Constitution and By-Laws.

2. That the committee chairman be mailed a current list of members. This list will be reviewed and checked against the membership list of the American Association of Economic Entomologists. Commercial pesticide companies will also be contacted to attempt to ascertain if other qualified and interested personnel in their employ may be contacted, in order to increase membership. A mimeographed letter can be prepared to send to these prospective new members.

3. A subscription list of educational institutions and commercial firms who are now receiving the FLORIDA ENTOMOLOGIST be provided the chairman of the committee. This list will be reviewed with the idea of contacting other similar institutions in an attempt to increase circulation of the Society's journal.

4. That all entomologists in the Southeast who are not now members of the Society be contacted by mimeographed letter urging them to join the Society.

5. That a table be set up (if permissable) at the February meeting in Memphis of the Cotton States Branch of the AAEE. Members of our committee can staff this table at certain intervals during the meeting to attempt to increase membership.

6. Preliminary programs be mailed to all members as early as possible before annual meeting. If this is done, attendance at meetings will be increased. Revenue from registration fees will also be increased. More dues can be collected. Many members wait to pay their dues at the meeting.

The Secretary was called upon for new business. A letter was read from Julien C. Younge, Director of Library of Florida History requesting the Society place in this library any printed material relating to the Society's activities. The Library of Florida has the FLORIDA ENTOMOLOGIST through Vol. 19, Nos. 1 and 2. The Secretary recommended the Society supply the Library of Florida History a subscription to the FLORIDA ENTOMOLOGIST beginning with Vol. 19, No. 3, which would be a permenant record of the Society. This motion passed.

The Secretary announced he had applications for 37 new members and 4 student members for action of the Executive Committee. The new members are:

Baerman, Gerard D., Box 886, Charleston, S. C.
Batte, Edward G., 1126 N. W. 8th St., Gainesville, Florida.
Bowery, Thomas G., Everglades Experiment Station, Belle Glade, Florida.
Boyd, Daniel Franklin, 214 Greyhound Bldg., Tampa, Florida.
Brown, Rue L., 607 S. 4th St., Ft. Pierce, Florida.
DeBusk, William T., Penn Salt Mfg. Co., Route 6, Box 11A, Montgomery, Alabama.
Fredrick, John M., Florida East Coast Fertilizer Co., Homestead, Florida.
Friedman, Herbert J., 214 Greyhound Bldg., Tampa, Florida.
Hale, Roger H., Route 1, Palmetto, Florida.
Harris Jr., Emmett D., General Delivery, Lake Alfred, Florida.
Harz, A. W., 13 W. Underwood St., Orlando, Florida.
Heald, Howell Levis, Citrus Experiment Station, Lake Alfred, Florida.
Henderson, H. Cecil, Box 1709, Jacksonville, Florida.
Howard, Frank L., Box 996, Winter Haven, Florida.
Irey, William R., 431 E. Central Ave., Orlando, Florida.
Johnson, Edward Carlton, P. O. Box 146, Pompano Beach, Florida.
Kimball, Charles Pond, Route 4, Box 299, Sarasota, Florida.
Kirkland, Robert O., 1001 S. Dakota, Tampa, Florida.
Mathias, Arthur F., 720 Glendale, Lakeland, Florida.
Mayeux, Herman S., General Delivery, Arlington, Florida.
Moore, L. H., Box 1028, Clemson, South Carolina.
Myers, Forrest Earl, Florida Agricultural Extension Service, Gainesville, Florida.
Nabors, C. Marion, P. O. Box 5737, Tampa, Florida.
Neal, J. H., Hercules Powder Co., 134 Peachtree Street, Atlanta, Georgia.
Palmer, Charles Malcolm, 340 E. Lemon, Bartow, Florida.
Reed, R. R., Gulf Fertilizer Co., Tampa, Florida.
Rohwer, George Gregor, 1290 Wesleyan Drive, Macon, Georgia.
Roig, Roy V., 512 S. 1st Street, Winter Haven, Florida.
Sells, J. Duncan, 1721 Dormont Street, Orlando, Florida.
Simaton, William A., Citrus Experiment Station, Lake Alfred, Florida.
Steuben, Edmund Bruno, P. O. Box 2013, University Station, Gainesville, Florida.
Stoddard, David L., 205 Walcaid Bldg., Bradenton, Florida.
Vaughn, Sam H., 1908 Conway Road, Orlando, Florida.
Watson, J. D., Penn Salt Mfg. Co., Route 6, Box 11A, Montgomery, Alabama.
Wells, Stafford Livingston, P. O. Box 687, Homestead, Florida.
Wirwille, James W., Penn Salt Mfg. Co., Route 6, Box 11A, Montgomery, Alabama.
Wright, M. L., 3302 Clay Street, Orlando, Florida.

Student Members:

Bartnett, Robert Earl, 208 N. W. 14th Street, Gainesville, Florida.
Cumming, Robert B., Box 3065, University Station, Gainesville, Florida.
Driggers, J. E., 623 N. W. 25th Ave., Gainesville, Florida.
Nirenberg, Marshall Warren, Box 145 Biology Department, University of Florida, Gainesville, Florida.
Theuer, B., Biology Department, University of Florida.
Treadwell, Joseph H., 18 N. W. 17th St., Gainesville, Florida.

Dr. Tissot brought up the proposal made by Mr. Oliver I. Snapp of the Georgia Entomological Society. The proposal, made by Mr. Snapp on September 13th, was that members of the Georgia Society would like to work out an agreement with the Florida Society whereby the Georgia members could publish in the FLORIDA ENTOMOLOGIST. Mr. Snapp said maybe something in the way of a subsidy could be given the Florida Society for the right of the Georgia members to publish their papers. A discussion followed Dr. Tissot's remarks. Dr. Berner said outsiders could publish in the FLORIDA ENTOMOLOGIST now and that no change would have to be made. Mr. Thames suggested the Executive Committee look into the matter and try to work out an agreement satisfactory to both societies. Dr. Tissot also recommended the Executive Committee investigate the matter. Dr. Griffiths said he did not think the Society should vote on the matter until the Executive Committee made a report at the next meeting. Mr. Deim said we should vote today and tell the Georgia Entomological Society they can publish. Mr. Mulrennan moved that the President appoint a committee of five (5) members to study the matter and report back at the next annual meeting, and that the Georgia Entomological Society be notified of the action taken. Motion passed. The following committee was appointed: A. N. Tissot, Chairman, George Merrill, Lewis Berner, W. P. Hunter, and Lewis Maxwell.

Mr. Bruce appointed Dr. Gray Butcher of Miami to represent the Society at the Governor's Highway Safety Conference to be held in Miami, September 27th and 28th, 1951.

Mr. Lewis Wright commented on the fact that many of the papers given at the annual meeting were never published in the FLORIDA ENTOMOLOGIST. He suggested that all speakers should send in their papers to be published. Mr. W. L. Thompson said that many speakers failed to send in their papers to be published and that he would be one to try and do better in the future. Dr. Berner reported that for the first time the FLORIDA ENTOMOLOGIST had a backlog of papers. Dr. Stoner suggested that maybe a summary of papers could be published if the backlog was large, so that the most recent information would be in the FLORIDA ENTOMOLOGIST. No action was taken on the above.

(To Be Continued Next Issue)

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